What is claimed is:

1. A method for use in fabrication of integrated circuits comprising:

providing a substrate assembly including an oxygen-containing surface portion;

forming a first metal layer on at least a portion of the oxygen-containing surface portion;

forming a second metal layer on at least a portion of the first metal layer;

providing an oxidation diffusion barrier layer on at least a portion of the second metal layer;

oxidizing one or more regions of the second metal layer to form metal oxide regions corresponding to one or more grain boundaries of the first metal layer by thermally treating the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon; and

removing the oxidation diffusion barrier layer and unoxidized portions of the second metal layer.

2. The method of claim 1, wherein oxidizing one or more regions of the second metal layer comprises annealing the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon at a temperature greater than 300 °C.

3. The method of claim 2, wherein annealing the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon comprises annealing the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon in a non-oxidizing atmosphere.

4. The method of claim 1, wherein the first metal layer is formed of at least one metal selected from a group consisting of platinum, palladium, rhodium, and iridium.

5. The method of claim 4, wherein the first metal layer is formed of at least platinum.

6. The method of claim 1, wherein the second metal layer is formed of at least one metal selected from a group consisting of ruthenium, osmium, rhodium, iridium, and cerium.

7. The method of claim 6, wherein the second metal layer is formed of at least ruthenium.

8. The method of claim 1, wherein the oxidation diffusion barrier layer is formed of at least one of silicon nitride, silicon oxynitride, and aluminum oxide.

9. The method of claim 1, wherein removing the unoxidized portions of the second metal layer comprises removing the unoxidized portions of the second metal layer relative to the metal oxide regions using at least one of a wet etch and a dry etch.

10. A method for use in fabrication of integrated circuits comprising:

providing a substrate assembly including an oxygen-containing surface portion;

forming a first metal layer on at least a portion of the oxygen-containing surface portion, the first metal layer having grain boundaries extending therethrough;

forming a second metal layer on at least a portion of the first metal layer; and

forming metal oxide regions on at least portions of the first metal layer at one or more grain boundaries thereof through selective oxidation of the second metal layer by diffusion of oxygen from the oxygen-containing surface portion through the one or more grain boundaries of the first metal layer.

11. The method of claim 10, wherein forming metal oxide regions on at least portions of the first metal layer at one or more grain boundaries thereof comprises:

providing an oxidation diffusion barrier layer on at least a portion of the second metal layer;

thermally treating the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon to selectively oxidize one or more regions of the second metal layer at the one or more grain boundaries of the first metal layer resulting in the one or more metal oxide regions and unoxidized portions of the second metal layer therebetween; and

removing the oxidation diffusion barrier layer and the unoxidized portions of the second metal layer.

12. The method of claim 11, wherein thermally treating the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon comprises annealing the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon at a temperature greater than 300 °C.

13. The method of claim 12, wherein annealing the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon comprises annealing the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon in a non-oxidizing atmosphere.

14. The method of claim 11, wherein removing the unoxidized portions of the second metal layer comprises removing the unoxidized portions of the second metal relative to the metal oxide regions using at least one of a wet etch and a dry etch.

15. The method of claim 10, wherein the first metal layer is formed of at least one metal selected from a group consisting of platinum, palladium, rhodium, and iridium.

16. The method of claim 15, wherein the first metal layer is formed of at least platinum.

17. The method of claim 10, wherein the second metal layer is formed of at least one metal selected from a group consisting of ruthenium, osmium, rhodium, iridium, and cerium.

18. The method of claim 17, wherein the second metal layer is formed of at least ruthenium.

19. The method of claim 10, wherein the oxidation diffusion barrier layer is formed of at least one of silicon nitride, silicon oxynitride, and aluminum oxide.

20. A method for use in fabrication of integrated circuits comprising:

providing a substrate assembly including an oxygen-containing surface portion;

forming a platinum layer on at least a portion of the oxygen-containing surface portion, the platinum layer having grain boundaries extending therethrough;

forming a ruthenium layer on at least a portion of the platinum layer;

forming ruthenium oxide regions on at least portions of the platinum layer at one or more grain boundaries thereof through selective oxidation of the ruthenium layer by diffusion of oxygen from the oxygen-containing surface portion through the one or more grain boundaries of the platinum layer.

21. The method of claim 20, wherein forming ruthenium oxide regions on at least portions of the platinum layer at one or more grain boundaries thereof comprises:

providing an oxidation diffusion barrier layer on at least a portion of the ruthenium layer;

thermally treating the substrate assembly having the platinum layer, ruthenium layer, and oxidation diffusion barrier layer formed thereon to selectively oxidize one or more regions of the ruthenium layer at the one or more grain boundaries of the platinum

layer resulting in the one or more ruthenium oxide regions and unoxidized ruthenium portions of the ruthenium layer therebetween; and

removing the oxidation diffusion barrier layer and the unoxidized ruthenium portions of the ruthenium layer.

22. The method of claim 21, wherein thermally treating the substrate assembly having the platinum layer, ruthenium layer, and oxidation diffusion barrier layer formed thereon comprises annealing the substrate assembly having the platinum layer, ruthenium layer, and oxidation diffusion barrier layer formed thereon at a temperature greater than 300 °C.

23. The method of claim 22, wherein annealing the substrate assembly having the platinum layer, ruthenium layer, and oxidation diffusion barrier layer formed thereon comprises annealing the substrate assembly having the platinum layer, ruthenium layer, and oxidation diffusion barrier layer formed thereon in a non-oxidizing atmosphere.

24. The method of claim 21, wherein removing the unoxidized ruthenium portions of the ruthenium layer comprises removing the unoxidized ruthenium portions of the ruthenium layer relative to the ruthenium oxide regions using at least one of a wet etch and a dry etch.

25. The method of claim 21, wherein the oxidation diffusion barrier layer is formed of at least one of silicon nitride, silicon oxynitride, and aluminum oxide.

26. The method of claim 21, wherein removing the unoxidized ruthenium portions of the ruthenium layer results in a first electrode of a capacitor structure comprising the first metal layer and the one or more ruthenium oxide regions formed thereon, and further wherein the method comprises:

forming a high dielectric constant material over at least a portion of the first electrode; and

forming a second electrode on at least a portion of the high dielectric constant material.

27. A method for use in formation of a capacitor comprising:

providing a substrate assembly including an oxygen-containing surface portion;

forming a first electrode on at least a portion of the oxygen-containing surface portion, wherein forming the first electrode comprises:

forming a first metal layer on at least a portion of the oxygen-containing surface portion,

forming a second metal layer on at least a portion of the first metal layer,

providing an oxidation diffusion barrier layer on at least a portion of the second metal layer,

oxidizing one or more regions of the second metal layer to form metal oxide regions corresponding to one or more grain boundaries of the first metal layer by thermally treating the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon, and

removing the oxidation diffusion barrier layer and unoxidized portions of the second metal layer;

forming a high dielectric constant material over at least a portion of the first electrode; and

forming a second electrode on at least a portion of the high dielectric constant material.

28. The method of claim 27, wherein oxidizing one or more regions of the second metal layer comprises annealing the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon at a temperature greater than 300 °C.

29. The method of claim 28, wherein annealing the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed

thereon comprises annealing the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon in a non-oxidizing atmosphere.

30. The method of claim 27, wherein the first metal layer is formed of at least one metal selected from a group consisting of platinum, palladium, rhodium, and iridium.

31. The method of claim 30, wherein the first metal layer is formed of at least platinum.

32. The method of claim 27, wherein the second metal layer is formed of at least one metal selected from a group consisting of ruthenium, osmium, rhodium, iridium, and cerium.

33. The method of claim 32, wherein the second metal layer is formed of at least ruthenium.

34. The method of claim 27, wherein the oxidation diffusion barrier layer is formed of at least one of silicon nitride, silicon oxynitride, and aluminum oxide.

35. The method of claim 27, wherein removing the unoxidized portions of the second metal layer comprises removing the unoxidized portions of the second metal relative to the metal oxide regions using at least one of a wet etch and a dry etch.

36. A method for use in formation of a capacitor comprising:

providing a substrate assembly including an oxygen-containing surface portion;

forming a first electrode on at least a portion of the oxygen-containing surface portion, wherein forming the first electrode comprises:

forming a first metal layer on at least a portion of the oxygen-containing surface portion, the first metal layer having grain boundaries extending therethrough,

forming a second metal layer on at least a portion of the first metal layer, and

forming metal oxide regions on at least portions of the first metal layer at one or more grain boundaries thereof through selective oxidation of the second metal layer by diffusion of oxygen from the oxygen-containing surface portion through the one or more grain boundaries of the first metal layer;

forming a high dielectric constant material over at least a portion of the first electrode; and

forming a second electrode on at least a portion of the high dielectric constant material.

37. The method of claim 36, wherein forming metal oxide regions on at least portions of the first metal layer at one or more grain boundaries thereof comprises:

providing an oxidation diffusion barrier layer on at least a portion of the second metal layer;

thermally treating the substrate assembly having the first metal layer, second metal layer, oxidation diffusion barrier layer formed thereon to selectively oxidize one or more regions of the second metal layer at the one or more grain boundaries of the first metal layer resulting in the one or more metal oxide regions and unoxidized portions of the second metal layer therebetween; and

removing the oxidation diffusion barrier layer and the unoxidized portions of the second metal layer.

38. The method of claim 37, wherein thermally treating the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer comprises annealing the substrate assembly having the first metal layer, second metal

layer, and oxidation diffusion barrier layer formed thereon at a temperature greater than 300 °C.

39. The method of claim 38, wherein annealing the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon comprises annealing the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon in a non-oxidizing atmosphere.

40. The method of claim 37, wherein removing the unoxidized portions of the second metal layer comprises removing the unoxidized portions of the second metal relative to the metal oxide regions using at least one of a wet etch and a dry etch.

41. The method of claim 36, wherein the first metal layer is formed of at least one metal selected from a group consisting of platinum, palladium, rhodium, and iridium.

42. The method of claim 41, wherein the first metal layer is formed of at least platinum.

43. The method of claim 36, wherein the second metal layer is formed of at least one metal selected from a group consisting of ruthenium, osmium, rhodium, iridium, and cerium.

44. The method of claim 43, wherein the second metal layer is formed of at least ruthenium.

45. The method of claim 36, wherein the oxidation diffusion barrier layer is formed of at least one of silicon nitride, silicon oxynitride, and aluminum oxide.

46. A semiconductor structure comprising:

a substrate assembly including an oxygen-containing surface portion;

a first metal layer on at least a portion of the oxygen-containing surface portion; and

one or more metal oxide regions formed from a second metal layer on at least portions of the first metal layer at one or more grain boundaries thereof.

47. The structure of claim 46, further comprising:

an oxidation diffusion barrier layer on at least a portion of the second metal layer over at least the one or more metal oxide regions; and

unoxidized portions of the second metal layer between the one or more metal oxide regions.

48. The structure of claim 47, wherein the oxidation diffusion barrier layer is formed at least one of silicon nitride, silicon oxynitride, and aluminum oxide.

49. The structure of claim 46, wherein the first metal layer is formed of at least one metal selected from a group consisting of platinum, palladium, rhodium, and iridium.

50. The structure of claim 49, wherein the first metal layer is formed of at least platinum.

51. The structure of claim 46, wherein the second metal layer is formed of at least one metal selected from a group consisting of ruthenium, osmium, rhodium, iridium, and cerium.

52. The structure of claim 51, wherein the second metal layer is formed of at least ruthenium.

53. A semiconductor structure comprising:

a substrate assembly including an oxygen-containing surface portion;

a platinum layer on at least a portion of the oxygen-containing surface portion; and

one or more ruthenium oxide regions formed from a ruthenium layer on at least portions of the platinum layer at one or more grain boundaries thereof.

54. The structure of claim 53, further comprising:

an oxidation diffusion barrier layer on at least a portion of the ruthenium layer over at least the one or more ruthenium oxide regions; and

unoxidized ruthenium portions of the ruthenium layer between the one or more ruthenium oxide regions.

55. The structure of claim 54, wherein the oxidation diffusion barrier layer is formed of at least one of silicon nitride, silicon oxynitride, and aluminum oxide.

56. The structure of claim 53, wherein the platinum layer and the one or more ruthenium oxide regions form at least a portion of a first electrode of a capacitor structure, and further wherein the capacitor structure comprises:

a high dielectric constant material formed over at least a portion of the first electrode; and

a second electrode on at least a portion of the high dielectric constant material.

57. A capacitor structure comprising:

a substrate assembly including an oxygen-containing surface portion;

a first electrode comprising a first metal layer on at least a portion of the oxygen-containing surface portion and one or more metal oxide regions formed from a second metal layer on at least portions of the first metal layer at one or more grain boundaries thereof; and

a high dielectric constant material formed over at least a portion of the first electrode; and

a second electrode on at least a portion of the high dielectric constant material.

58. The capacitor structure of claim 57, wherein the first metal layer is formed of at least one metal selected from a group consisting of platinum, palladium, rhodium, and iridium.

59. The capacitor structure of claim 58, wherein the first metal layer is formed of at least platinum.

60. The capacitor structure of claim 57, wherein the second metal layer is formed of at least one metal selected from a group consisting of ruthenium, osmium, rhodium, iridium, and cerium.

61. The capacitor structure of claim 60, wherein the second metal layer is formed of at least ruthenium.

62. A memory cell structure comprising:

a substrate assembly including at least one active device and having an oxygen-containing surface portion; and

a capacitor formed relative to the at least one active device, the capacitor comprising:

a first electrode comprising a first metal layer on at least a portion of the oxygen-containing surface portion and one or more metal oxide regions formed from a second metal layer on at least portions of the first metal layer at one or more grain boundaries thereof,

a high dielectric constant material formed over at least a portion of the first electrode, and

a second electrode on at least a portion of the high dielectric constant material.

63. The structure of claim 62, wherein the first metal layer is formed of at least one metal selected from a group consisting of platinum, palladium, rhodium, and iridium.

64. The structure of claim 63, wherein the first metal layer is formed of at least platinum.

65. The structure of claim 62, wherein the second metal layer is formed of at least one metal selected from a group consisting of ruthenium, osmium, rhodium, iridium, and cerium.

66. The structure of claim 65, wherein the second metal layer is formed of at least ruthenium.

67. A method for use in fabrication of integrated circuits comprising:

providing a substrate assembly comprising a surface, wherein the surface comprises oxygen;

forming a first metal layer on at least a portion of the surface;

forming a second metal layer on at least a portion of the first metal layer;

forming an oxidation diffusion barrier layer on at least a portion of the second metal layer; and

causing oxygen to diffuse through the first metal layer to oxidize one or more regions of the second metal layer.

68. The method of claim 67, wherein causing oxygen to diffuse through the first metal layer to oxidize regions of the second metal layer comprises thermally treating the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon.

69. The method of claim 68, wherein thermally treating the substrate assembly comprises annealing the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon at a temperature greater than 300 °C.

70. The method of claim 69, wherein annealing the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon comprises annealing the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon in a non-oxidizing atmosphere.

71. The method of claim 67, wherein the first metal layer comprises at least one metal selected from a group consisting of platinum, palladium, rhodium, and iridium.

72. The method of claim 71, wherein the first metal layer comprises platinum.

73. The method of claim 67, wherein the second metal layer comprises at least one metal selected from a group consisting of ruthenium, osmium, rhodium, iridium, and cerium.

74. The method of claim 73, wherein the second metal layer comprises ruthenium.

75. The method of claim 67, wherein the oxidation diffusion barrier layer comprises at least one of silicon nitride, silicon oxynitride, and aluminum oxide.

76. The method of claim 67, wherein the method further comprises removing the oxidation diffusion barrier layer and unoxidized portions of the second metal layer.

77. The method of claim 76, wherein removing the unoxidized portions of the second metal layer comprises removing the unoxidized portions of the second metal layer relative to the metal oxide regions using at least one of a wet etch and a dry etch.

78. A method for use in fabrication of integrated circuits comprising:

providing a substrate assembly comprising a surface, wherein the surface comprises oxygen;

forming a first metal layer on at least a portion of the surface, the first metal layer comprising one or more grain boundaries;

forming a second metal layer on at least a portion of the first metal layer; and

forming metal oxide regions on at least portions of the first metal layer through oxidation of at least portions of the second metal layer by diffusion of oxygen through one or more grain boundaries of the first metal layer.

79. The method of claim 78, wherein forming metal oxide regions on at least portions of the first metal layer comprises:

providing an oxidation diffusion barrier layer on at least a portion of the second metal layer;

thermally treating the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon to selectively oxidize one or more regions of the second metal layer at the one or more grain boundaries of the first metal layer resulting in the one or more metal oxide regions and unoxidized portions of the second metal layer; and

removing the oxidation diffusion barrier layer and the unoxidized portions of the second metal layer.

80. The method of claim 79, wherein thermally treating the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon comprises annealing the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon at a temperature greater than 300 °C.

81. The method of claim 80, wherein annealing the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon comprises annealing the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon in a non-oxidizing atmosphere.

82. The method of claim 79, wherein removing the unoxidized portions of the second metal layer comprises removing the unoxidized portions of the second metal relative to the metal oxide regions using at least one of a wet etch and a dry etch.

83. The method of claim 78, wherein the first metal layer comprises at least one metal selected from a group consisting of platinum, palladium, rhodium, and iridium.

84. The method of claim 83, wherein the first metal layer comprises platinum.

85. The method of claim 78, wherein the second metal layer comprises at least one metal selected from a group consisting of ruthenium, osmium, rhodium, iridium, and cerium.

86. The method of claim 85, wherein the second metal layer comprises ruthenium.

87. The method of claim 78, wherein the oxidation diffusion barrier layer comprises at least one of silicon nitride, silicon oxynitride, and aluminum oxide.

88. A method for use in fabrication of integrated circuits comprising:

providing a substrate assembly comprising a surface, wherein the surface comprises oxygen;

forming a platinum layer on at least a portion of the surface;

forming a ruthenium layer on at least a portion of the platinum layer; and

forming ruthenium oxide regions on at least portions of the platinum layer through selective oxidation of the ruthenium layer.

89. The method of claim 88, wherein forming ruthenium oxide regions on at least portions of the platinum layer through selective oxidation of the ruthenium layer comprises:

providing an oxidation diffusion barrier layer on at least a portion of the ruthenium layer;

thermally treating the substrate assembly having the platinum layer, ruthenium layer, and oxidation diffusion barrier layer formed thereon to selectively oxidize one or more regions of the ruthenium layer by diffusion of oxygen through one or more grain boundaries of the platinum layer.

90. The method of claim 89, wherein thermally treating the substrate assembly having the platinum layer, ruthenium layer, and oxidation diffusion barrier layer formed thereon comprises annealing the substrate assembly having the platinum layer, ruthenium

layer, and oxidation diffusion barrier layer formed thereon at a temperature greater than 300 °C.

91. The method of claim 89, wherein annealing the substrate assembly having the platinum layer, ruthenium layer, and oxidation diffusion barrier layer formed thereon comprises annealing the substrate assembly having the platinum layer, ruthenium layer, and oxidation diffusion barrier layer formed thereon in a non-oxidizing atmosphere.

92. The method of claim 89, wherein the thermal treatment results in the one or more ruthenium oxide regions and unoxidized ruthenium portions of the ruthenium layer, and further wherein the method comprises removing the oxidation diffusion barrier layer and the unoxidized portions of the ruthenium layer.

93. The method of claim 92, wherein removing the unoxidized ruthenium portions of the ruthenium layer comprises removing the unoxidized ruthenium portions of the ruthenium layer relative to the ruthenium oxide regions using at least one of a wet etch and a dry etch.

94. The method of claim 92, wherein removing the unoxidized ruthenium portions of the ruthenium layer results in a first electrode of a capacitor structure comprising the first metal layer and the one or more ruthenium oxide regions formed thereon, and further wherein the method comprises:

forming a dielectric material over at least a portion of the first electrode; and
forming a second electrode on at least a portion of the dielectric material.

95. The method of claim 88, wherein the oxidation diffusion barrier layer comprises at least one of silicon nitride, silicon oxynitride, and aluminum oxide.

96. A method for forming a capacitor comprising:

providing a substrate assembly comprising a surface material, wherein the surface material comprises oxygen;

forming a first electrode on at least a portion of the surface material, wherein forming the first electrode comprises:

forming a first metal layer on at least a portion of the surface material,

forming a second metal layer on at least a portion of the first metal layer,

forming an oxidation diffusion barrier layer on at least a portion of the second metal layer,

oxidizing at least a portion of the second metal layer to form one or more metal oxide regions by thermal treatment of the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon, and

removing the oxidation diffusion barrier layer and unoxidized portions of the second metal layer;

forming a dielectric material over at least a portion of the first electrode; and

forming a second electrode on at least a portion of the dielectric material.

97. The method of claim 96, wherein oxidizing at least a portion of the second metal layer to form one or more metal oxide regions by thermal treatment comprises annealing the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon at a temperature greater than 300 °C.

98. The method of claim 97, wherein annealing the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon comprises annealing the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon in a non-oxidizing atmosphere.

99. The method of claim 96, wherein the first metal layer comprises at least one metal selected from a group consisting of platinum, palladium, rhodium, and iridium.

100. The method of claim 99, wherein the first metal layer comprises platinum.

101. The method of claim 96, wherein the second metal layer comprises at least one metal selected from a group consisting of ruthenium, osmium, rhodium, iridium, and cerium.

102. The method of claim 101, wherein the second metal layer comprises ruthenium.

103. The method of claim 96, wherein the oxidation diffusion barrier layer comprises at least one of silicon nitride, silicon oxynitride, and aluminum oxide.

104. The method of claim 96, wherein removing the unoxidized portions of the second metal layer comprises removing the unoxidized portions of the second metal relative to the one or more metal oxide regions using at least one of a wet etch and a dry etch.

105. A method for use in formation of a capacitor comprising:

providing a substrate assembly comprising a surface, wherein the surface comprises oxygen;

forming a first electrode on at least a portion of the surface, wherein forming the first electrode comprises:

forming a first metal layer on at least a portion of the surface portion,

forming a second metal layer on at least a portion of the first metal layer, and

forming one or more metal oxide regions on at least portions of the first metal layer through selective oxidation of the second metal layer;

forming a dielectric material over at least a portion of the first electrode; and

forming a second electrode on at least a portion of the dielectric material.

106. The method of claim 105, wherein forming metal oxide regions comprises:

providing an oxidation diffusion barrier layer on at least a portion of the second metal layer;

thermally treating the substrate assembly having the first metal layer, second metal layer, oxidation diffusion barrier layer formed thereon to selectively oxidize one or more regions of the second metal layer by diffusion of oxygen through one or more grain boundaries of the first metal layer resulting in the one or more metal oxide regions and unoxidized portions of the second metal layer; and

removing the oxidation diffusion barrier layer and the unoxidized portions of the second metal layer.

107. The method of claim 106, wherein thermally treating the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer comprises annealing the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon at a temperature greater than 300 °C.

108. The method of claim 107, wherein annealing the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon comprises annealing the substrate assembly having the first metal layer, second metal layer, and oxidation diffusion barrier layer formed thereon in a non-oxidizing atmosphere.

109. The method of claim 106, wherein removing the unoxidized portions of the second metal layer comprises removing the unoxidized portions of the second metal relative to the metal oxide regions using at least one of a wet etch and a dry etch.

110. The method of claim 105, wherein the first metal layer comprises at least one metal selected from a group consisting of platinum, palladium, rhodium, and iridium.

111. The method of claim 110, wherein the first metal layer comprises platinum.

112. The method of claim 105, wherein the second metal layer comprises at least one metal selected from a group consisting of ruthenium, osmium, rhodium, iridium, and cerium.

113. The method of claim 112, wherein the second metal layer comprises ruthenium.

114. The method of claim 105, wherein the oxidation diffusion barrier layer comprises at least one of silicon nitride, silicon oxynitride, and aluminum oxide.